

# EXERCISES

For more practice, see *Extra Practice*.

## Practice and Problem Solving

### A Practice by Example

#### Example 1 (page 615)

Write the standard equation of each circle.

1. center  $(2, -8)$ ;  $r = 9$
2. center  $(0, 3)$ ;  $r = 7$
3. center  $(0.2, 1.1)$ ;  $r = 0.4$
4. center  $(5, -1)$ ;  $r = 12$
5. center  $(-6, 3)$ ;  $r = 8$
6. center  $(-9, -4)$ ;  $r = \sqrt{5}$
7. center  $(0, 0)$ ;  $r = 4$
8. center  $(-4, 0)$ ;  $r = 3$
9. center  $(-1, -1)$ ;  $r = 1$

#### Example 2 (page 616)

Write the standard equation of the circle with the given center that passes through the given point.

10. center  $(-2, 6)$ ; point  $(-2, 10)$
11. center  $(1, 2)$ ; point  $(0, 6)$
12. center  $(7, -2)$ ; point  $(1, -6)$
13. center  $(-10, -5)$ ; point  $(-5, 5)$
14. center  $(6, 5)$ ; point  $(0, 0)$
15. center  $(-1, -4)$ ; point  $(-4, 0)$

#### Example 3 (page 616)

Find the center and radius of the circle with the given equation. Then graph the circle.

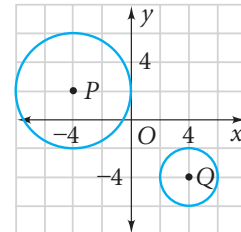
16.  $(x + 7)^2 + (y - 5)^2 = 16$
17.  $(x - 3)^2 + (y + 8)^2 = 100$
18.  $(x + 4)^2 + (y - 1)^2 = 25$
19.  $x^2 + y^2 = 36$
20.  $(x - 0.3)^2 + y^2 = 0.04$
21.  $(x + 5)^2 + (y + 2)^2 = 48$

#### Example 4 (page 617)

Use the diagram at the right. Write an equation that describes the position and radius of each circle.

22.  $\odot P$
23.  $\odot Q$

24. **Communications** The plotted location of a cellular phone tower on a coordinate grid is  $(-3, 2)$  and the range is 5 units. Write an equation that describes the position and range of the tower.

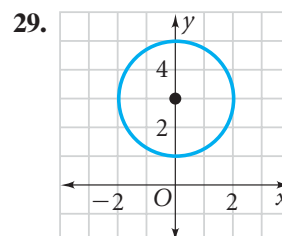
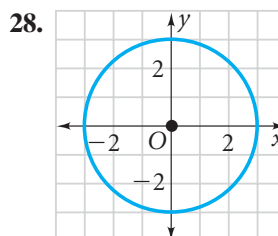
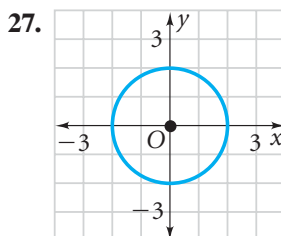


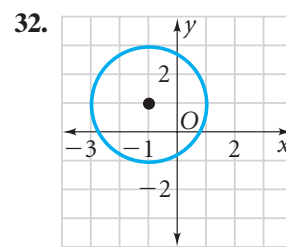
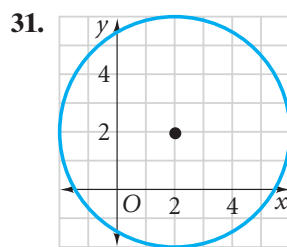
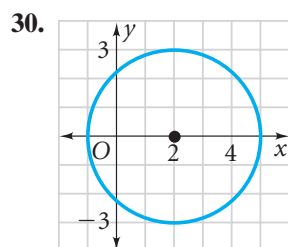
Each equation models the position and range of a tornado alert siren. Describe the position and range of each.

25.  $(x - 5)^2 + (y - 7)^2 = 81$
26.  $(x + 4)^2 + (y - 9)^2 = 144$

### B Apply Your Skills

Write the standard equation of each circle.





### Need Help?

In Exercises 33–38, use the Midpoint Formula (p. 45) to find centers.

Write an equation of a circle with diameter  $\overline{AB}$ .

33.  $A(0, 0), B(8, 6)$       34.  $A(3, 0), B(7, 6)$       35.  $A(1, 1), B(5, 5)$   
 36.  $A(-1, 0), B(-5, -3)$       37.  $A(-3, 1), B(0, 9)$       38.  $A(-2, 3), B(6, -7)$

39. The *unit circle* has center  $(0, 0)$  and radius 1. Write an equation for this circle.

40. **Critical Thinking** Describe the graph of  $x^2 + y^2 = r^2$  when  $r = 0$ .

41. **Open-Ended** On graph paper, make a design that includes at least three circles. Write the standard equations of your circles.

Determine whether each equation is an equation of a circle. If not, explain.

42.  $(x - 1)^2 + (y + 2)^2 = 9$       43.  $x + y = 9$       44.  $x + (y - 3)^2 = 9$

45. Find the circumference and area of the circle whose equation is  $(x - 9)^2 + (y - 3)^2 = 64$ . Leave your answers in terms of  $\pi$ .

46. Write an equation of a circle with area  $36\pi$  and center  $(4, 7)$ .

47. What are the  $x$ - and  $y$ -intercepts of the line tangent to the circle  $(x - 2)^2 + (y - 2)^2 = 5^2$  at the point  $(5, 6)$ ?

48. For  $(x - h)^2 + (y - k)^2 = r^2$ , show that  $y = \sqrt{r^2 - (x - h)^2} + k$ , or  $y = -\sqrt{r^2 - (x - h)^2} + k$ .



### Take It to the NET

Graphing Calculator procedures online at [www.PHSchool.com](http://www.PHSchool.com)  
 Web Code: afe-2110



**Graphing Calculator** Use a graphing calculator to graph each circle. (*Hint: See Exercise 48.*) View the plotting in both sequential mode and simultaneous mode.

49.  $(x - 3)^2 + (y - 2)^2 = 9$       50.  $(x + 5)^2 + (y - 8)^2 = 1$   
 51. circle with center  $(0, 0)$  and radius 7      52. circle with center  $(-6, -3)$  and radius 2

Find all points of intersection of each pair of graphs. Make a sketch.

53.  $x^2 + y^2 = 13$       54.  $x^2 + y^2 = 17$       55.  $x^2 + y^2 = 8$   
 $y = -x + 5$        $y = -\frac{1}{4}x$        $y = 2$   
 56.  $x^2 + y^2 = 20$       57.  $(x + 1)^2 + (y - 1)^2 = 18$       58.  $(x - 2)^2 + (y - 2)^2 = 10$   
 $y = -\frac{1}{2}x + 5$        $y = x + 8$        $y = -\frac{1}{3}x + 6$



**Graphing Calculator** Use a graphing calculator to convince yourself that the given line is not tangent to the circle  $x^2 + y^2 = 25$ . Explain what you did.

59.  $y = -5x + 26$       60.  $3x + 5y = 29$



61. **Writing** Explain why it is not possible to conclude that a line and a circle are tangent by viewing their graphs.



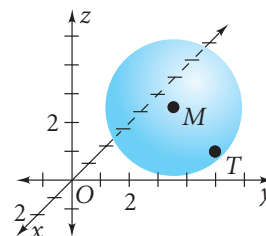
### Challenge

62. Lines  $y = \frac{2}{3}x + 3$  and  $y = 5$  cut the ring formed by circles  $(x - 3)^2 + (y - 5)^2 = 64$  and  $(x - 3)^2 + (y - 5)^2 = 25$  into four parts. Find the area of each part.



- 63. Nautical Distance** The radius of Earth's equator is about 3960 miles.
- Write the equation of the equator with the center of Earth as the origin.
  - Find the length of a  $1^\circ$  arc on the equator to the nearest tenth of a mile.
  - A  $1^\circ$  arc along the equator is 60 nautical miles long. How many miles are in a nautical mile? Round to the nearest tenth.
  - History** Columbus planned his trip to the East by going west. He thought each  $1^\circ$  arc was 45 miles long. He estimated that the trip would take 21 days. Use your answer to part (b) to find a better estimate.

- 64. Geometry in 3 Dimensions** The equation of a sphere is similar to the equation of a circle. The equation of a sphere with center  $(h, j, k)$  and radius  $r$  is  $(x - h)^2 + (y - j)^2 + (z - k)^2 = r^2$ .
- $M(-1, 3, 2)$  is the center of a sphere passing through  $T(0, 5, 1)$ . What is the radius of the sphere?
  - Write an equation of the sphere.



## Standardized Test Prep

### Multiple Choice

65. What is an equation of a circle with radius 16 and center  $(2, -5)$ ?
- $(x - 2)^2 + (y + 5)^2 = 16$
  - $(x + 2)^2 + (y - 5)^2 = 256$
  - $(x + 2)^2 + (y - 5)^2 = 4$
  - $(x - 2)^2 + (y + 5)^2 = 256$
66. What are the coordinates of the center of the circle whose equation is  $(x - 9)^2 + (y + 4)^2 = 1$ ?
- $(3, -2)$
  - $(-3, 2)$
  - $(-9, 4)$
  - $(9, -4)$
67. What is the diameter of the circle with equation  $(x - 1)^2 + (y + 1)^2 = 4$ ?
- 1
  - 2
  - 4
  - 16



### Take It to the NET

Online lesson quiz at  
[www.PHSchool.com](http://www.PHSchool.com)  
Web Code: afa-1105

### Short Response

68. Show how to find the radius of the circle whose equation is  $x^2 + (y + 8)^2 = 25$ .

### Extended Response

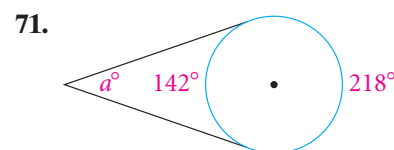
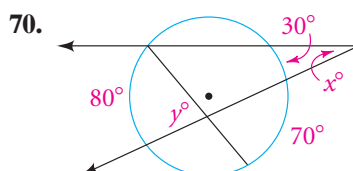
69. The line represented by the equation  $y = -\frac{4}{3}x + 11$  is tangent to a circle at  $(6, 3)$ . The center of the circle is on the  $x$ -axis. Write an equation of the circle. Show your work.



## Mixed Review

### Lesson 11-4

Find the value of each variable. Assume that lines that appear tangent are tangent.



### Lesson 9-4

For the given vectors  $\vec{a}$  and  $\vec{c}$ , write the sum  $\vec{a} + \vec{c}$  as an ordered pair.

72.  $\vec{a} = \langle -2, 5 \rangle$  and  $\vec{c} = \langle 8, 7 \rangle$

73.  $\vec{a} = \langle -3, -4 \rangle$  and  $\vec{c} = \langle -2, 6 \rangle$

74.  $\vec{a} = \langle 3, 1 \rangle$  and  $\vec{c} = \langle 1, 3 \rangle$

75.  $\vec{a} = \langle 9, -6 \rangle$  and  $\vec{c} = \langle 2, -1 \rangle$

**Lesson 8-4****Find the geometric mean of each pair of numbers in simplest radical form.**

**76.** 3 and 12

**77.** 9 and 27

**78.** 4 and 18

**79.**  $\sqrt{3}$  and  $\sqrt{27}$

**80.**  $\sqrt{3}$  and  $\sqrt{12}$

**81.**  $\frac{3}{8}$  and  $\frac{3}{2}$